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EXAMINER	
PAREKH, NITIN	
ART UNIT	**PAPER NUMBER**
2811	

DATE MAILED: 11/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/258,961	Applicant(s) JIANG ET AL.	
	Examiner Nitin Parekh	Art Unit 2811	AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 September 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *24-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *24-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03-01-1999* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 24 and 25 are rejected under 35 U.S.C. 102(a) as being anticipated by Lee et al. (US Pat. 5796586).

Regarding claim 24, Lee et al. disclose a semiconductor package comprising:

- a substrate (16 in Fig. 1A-1C) comprising a first/bottom and second/top surfaces (not numerically referenced- see Fig. 1A)
- a semiconductor die (20 in Fig. 1A) having a first outline (not numerically referenced- see the die 20 having the outline defining the die dimensions on the die attach area in the central portion in Fig. 1C) and a face being bonded directly to the second surface
- a first solder mask (14A in Fig. 1A) on the first/bottom surface of the substrate
- a second solder mask (18 in Fig. 1A) covering the second/top surface of the substrate except in a die attach area defined by an opening through the second solder mask having a second outline (see the outline/hatched area 18 in Fig. 1C) corresponding to or slightly larger than the first outline

- an adhesive layer (not numerically referenced in Fig. 1A; see Col. 6, lines 32-35) between the face and the die attach area bonding the die directly to the second/top surface of the substrate, and
- an encapsulating material/epoxy resin (25 in Fig. 1A) on the die and the second mask

(Fig. 1A-1C; Col. 1, line 34-Col. 2, line 65).

Regarding claim 25, Lee et al. substantially teach the entire claimed structure as applied to claim 24 above, wherein Lee et al. further teach the second outline being only slightly larger than the first outline (see Fig. 1A-1C).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US Pat. 5796586) in view of Hoffman et al. (US Pat. 5360942).

Regarding claim 26, Lee et al. teach substantially the entire claimed structure as applied to the claims 24 and 25 above, except the adhesive layer comprising a filled adhesive configured to transfer heat from the face to the second surface.

Lee et al. further teach in another embodiment, the die bonding structure having different adhesives including a conductive epoxy (Col. 6, line 45-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the adhesive layer comprising a filled adhesive configured to transfer heat from the face to the second surface as taught by Hoffman et al. so that the adhesion, thermal performance and reliability for the package can be improved in Lee et al's package.

Regarding claim 27, Lee et al. disclose a semiconductor package comprising:

- a substrate (16 in Fig. 1A-1C) comprising a first/bottom and second/top surfaces (not numerically referenced- see Fig. 1A)

- a semiconductor die (20 in Fig. 1A) having a first outline (not numerically referenced- see unhatched die attach area in the central portion in Fig. 1C) and a face being bonded directly to the second surface
- a first solder mask (14A in Fig. 1A) on the first/bottom surface of the substrate
- a second solder mask (18 in Fig. 1A) covering the second/top surface of the substrate except in a die attach area defined by an opening through the second solder mask having a second outline (see the outline/hatched area 18 in Fig. 1C) corresponding to or slightly larger than the first outline
- a conventional adhesive layer (not numerically referenced in Fig. 1A; see Col. 6, lines 32-35) between the face and the die attach area bonding the die directly to the second/top surface of the substrate, and
- an encapsulating material/epoxy resin (25 in Fig. 1A) on the die and the second mask

(Fig. 1A-1C; Col. 1, line 34-Col. 2, line 65).

Lee et al. fail to teach using the filled adhesive layer between the face and die attach area bonding the die to the substrate and being configured to transfer heat from the face to the second surface.

Lee et al. further teach in another embodiment, the die bonding structure having different adhesives including the conductive epoxy (Col. 6, line 45-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the filled adhesive layer between the face and die attach area bonding the die to the substrate and being configured to transfer heat from the face to the second surface as taught by Hoffman et al. so that the adhesion/bonding, thermal performance and reliability for the package can be improved in Lee et al's package.

Regarding claim 28, Lee et al. and Hoffman et al. teach substantially the entire claimed structure as applied to the claim 27 above, wherein Lee et al. further teach the adhesive layer comprising the conductive epoxy (Col. 6, line 45-50).

Regarding claim 29, Lee et al. and Hoffman et al. teach substantially the entire claimed structure as applied to the claim 27 above, wherein Lee et al. further teach the second outline being only slightly larger than the first outline (Fig. 1A-1C).

5. Claims 30-32, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over admitted prior art (APA) in view of Lee et al. (US Pat. 5796586).

Regarding claim 30, APA (Fig.1A and B; pages 2-4) discloses a semiconductor package comprising :

- a substrate (12 in Fig. 1A) comprising a first and second surfaces (24 and 22 respectively in Fig. 1A),a plurality of conductors/pads formed on the first surface and a bonding opening (26 in Fig. 1A) from the first surface to the second surface
- a semiconductor die (16 in Fig. 1A) having a face being aligned with the bonding opening and attached/bonded to the second surface on a die attach area using an adhesive (34 in Fig. 1A)
- first mask (20A in Fig. 1A) on the first surface of the substrate
- a second mask (20B in Fig. 1A) substantially covering a second surface of the substrate
- the adhesive layer between the die/face and the substrate in the die attach area to bond the die to the second mask and the substrate,
- a plurality of wires (28 in Fig. 1A) placed through the bonding opening and wire bonded to the die and being in electrical communication with the respective conductors
- an encapsulating material/epoxy resin (38 in Fig. 1A) on the die and the second mask, and
- a glob top/polymer (40 in Fig. 1A) in the bonding opening encapsulating the wire.

APA fails to teach:

a) the second mask being on the second surface except the die attach area, and

b) the adhesive layer being the filled adhesive layer attaching the face directly to the die attach area and being configured to transfer heat from the face to the substrate.

a) Lee et al. teach using a second mask having an opening through the mask (see hatched mask area 218' in Fig. 7; Col. 7, line 55) having a surface area on the second surface except the die attach area (see 204- Fig. 7) on the second surface so that the die is directly bonded to the die attach area on the second surface to provide the area with improved adhesion with the substrate (see abstract: lines 8-11; Fig. 7; Col. 7, line 55- Col. 8, line 35).

b) Lee et al. further teach the die bonding structure where the die is attached directly to the substrate surface using a variety of adhesives including the conductive/filler-based epoxy (not numerically referenced in Fig. 7; Col. 6, lines 30-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the second mask being on the second surface

except die attach area as taught by Lee et al. and the adhesive layer being the filled adhesive layer attaching the face directly to the die attach area and being configured to transfer heat from the face to the substrate as taught by Hoffman et al. so that the adhesion, thermal performance and reliability for the package can be improved in APA's package.

Regarding claim 31, APA and Lee et al. substantially teach the entire claimed structure as applied to claim 30 above, except the die attach area having an outline only slightly larger than that of the die.

Lee et al. further teach an outline defining the die attach area (see area 204- Fig. 7) on the second surface, the outline being only slightly larger than that of the die (see relative dimensions of the die and area 204 in Fig. 4 and 7).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the die attach area having an outline only slightly larger than that of the die by Lee et al. so that the adhesion at the peripheral portions of the die can be improved and contamination and defects at the perimeter interfaces can be reduced in Lee et al. and APA's package.

Regarding claim 32, APA and Lee et al. teach substantially the entire claimed structure as applied to claim 30 above, wherein APA (Fig.1A and B; pages 2-4) further teaches the substrate comprising an organic polymer/polyimide resin (specification page 2, lines 26-28).

Regarding claims 34 and 35, APA (Fig.1A and B; pages 2-4) discloses a semiconductor package comprising :

- a substrate (12 in Fig. 1A) comprising a first and second surfaces (24 and 22 respectively in Fig. 1A),a plurality of conductors/pads formed on the first surface and a bonding opening (26 in Fig. 1A) from the first surface to the second surface
- a semiconductor die (16 in Fig. 1A) having a first outline (not numerically referenced- see the die 20 having the outline defining the die dimensions on the die attach area in the central portion in Fig. 1C) and a face being aligned with the bonding opening and attached/bonded face down to the second surface on a die attach area using an adhesive (34 in Fig. 1A)
- first mask (20A in Fig. 1A) on the first surface of the substrate
- a second mask (20B in Fig. 1A) substantially covering a second surface of the substrate
- the adhesive layer between the die/face and the substrate in the die attach area to bond the die to the second mask and the substrate,
- a plurality of wires (28 in Fig. 1A) placed through the bonding opening and wire bonded to the die and being in electrical communication with the respective conductors
- an encapsulating material/epoxy resin (38 in Fig. 1A) on the die and the second mask, and
- a glob top/polymer (40 in Fig. 1A) in the bonding opening encapsulating the wire.

APA fails to teach:

a) the die being bonded directly to the second surface, the second surface having the second mask including an opening there through having a second outline corresponding to but only slightly larger than the first outline, and

b) the adhesive layer bonding the die directly to the second surface.

a) Lee et al. teach using a second mask having an opening through the mask with a second outline (see hatched mask area 218' with a second outline- Fig. 7; Col. 7, line 55) corresponding to or only slightly larger than the first outline (see the outline of the die 220 and the area 218' in Fig. 4 and Fig. 7) on the second surface so that the die is directly bonded to the second surface to provide an area with improved adhesion with the substrate (see abstract: lines 8-11; Fig. 7 and Fig. 1-6; Col. 1-8).

b) Lee et al. further teach the die bonding structure where the die is attached directly to the substrate surface using a variety of adhesives including the conductive/filler-based epoxy (not numerically referenced in Fig. 7; Col. 6, lines 30-50).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the die being bonded directly to the second surface, the second surface having the second mask including an opening there through having a second outline corresponding to but slightly larger than the first outline and the

adhesive layer bonding the die directly to the second surface as taught by Lee et al. so that the adhesion, bonding to the substrate and the reliability of the package can be improved in the APA.

6. Claims 33 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over APA and Lee et al. (US Pat. 5796586) as applied to claims 30 and 34 above respectively, and in further in view of Hoffman et al. (US Pat. 5360942).

Regarding claim 33, the APA and Lee et al. teach substantially the entire claimed structure as applied to the claim 30 above, except the adhesive layer comprising a filled epoxy.

Lee et al. further teach in another embodiment, the die bonding structure having different adhesives including a conductive epoxy (Col. 6, line 45-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the adhesive layer comprising a filled adhesive configured to transfer heat from the face to the second surface as taught by Hoffman et al. so that the adhesion, thermal performance and reliability for the package can be improved in Lee et al. and APA's package.

Regarding claim 36, the APA and Lee et al. teach substantially the entire claimed structure as applied to the claim 34 above, except the adhesive layer comprising a filled adhesive.

Lee et al. further teach in another embodiment, the die bonding structure having different adhesives including a conductive epoxy adhesive (Col. 6, line 45-50).

Hoffman et al. teach using a die attach/adhesive material comprising a filled epoxy/adhesive (40 in Fig. 3) configured to provide improved heat transfer and/or electrical conductivity (Col. 3, line 60- Col. 4, line 2).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the adhesive layer comprising the filled adhesive configured to transfer heat from the face to the second surface as taught by Hoffman et al. so that the adhesion, thermal performance and reliability for the package can be improved in Lee et al. and APA's package.

Response to Arguments

7. Applicant's arguments filed on 09-22-03 have been fully considered but they are not persuasive.

A. Applicant contends that Lee et al. teach the structure having the back of the die directly transferring the heat to the substrate but do not teach the heat being transferred from face of the die.

However, as explained above, APA teaches board on chip structure where the face of the die is attached to the substrate. Lee et al. teach bonding the die directly to the substrate through the adhesive layer only without using the solder mask layer in the die attach area. Therefore, Lee et al. is combined with APA to achieve the configuration of the direct attachment of the die to the substrate such that the heat is transferred directly from the face of the die to the substrate.

B. Applicant contends that Lee et al. teach the die attach area being substantially larger than the outline of the die and do not teach the same being only slightly larger than the outline of the die.

However, as explained above, Lee et al. teach the second solder mask (18 in Fig. 1A) covering the second/top surface of the substrate except in the die attach area (see 204 in Fig. 4 and 7) defined by the opening through the second solder mask having the second outline (see the outline/hatched area 18 in Fig. 1C), the die attach area being only slightly larger than the outline of the die (see 220 and 204 in Fig. 4 and 7), such representation of the area being slightly larger, is similar to that of the solder mask 80A shown in Fig. 7 of the invention.

C. Applicant contends that there is no teaching of having improved adhesion in Lee et al. by using the direct attachment of the die to the substrate.

However, as explained above, Lee et al. teach the central portion of the substrate providing the area without the solder mask which is substantially more adhesive than the outer portion covered with the solder mask (see abstract: lines 8-11; Fig. 7).

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh whose telephone number is 703-305-3410. The examiner can normally be reached on 09:00AM-05:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 703-305-1690. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9318.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Nitin Parekh

NP

11-18-03

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